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ABSTRACT

This three-part study of early identification of developmental deficiencies in high risk infants was undertaken to determine whether infant performance can be predicted from neonatal and developmental criteria. Part I of the study began in 1977 and used 284 high risk infants as subjects. Part II was initiated in 1978. Subjects were 14 full-term, and 10 premature infants. Part III, initiated in 1979-80, evaluated 119 hospitalized high risk infants. In general, the "Neonatal Behavioral Assessment Scale" (NBAS), in combination with medical histories and developmental assessments, was found to predict mental and motor performance at 9 months on the "Bayley Scales of Infant Development" (BSID). NBAS assessments at as early as 30 weeks gestational age were found related to BSID assessments at 2, 3, and 4 months of age. Patterns of pre-term infant performance on the NBAS emerged at 35 weeks gestational age. Discriminate analysis yielded one hundred percent prediction of 9-month performance on the BSID and pre-term or full-term group membership. NBAS subscales and medical histories provided 3 of 4 predictors of normal function and 11 of 11 predictors of abnormal function. The study concludes that a neonatal interdisciplinary involvement with "at risk" or pre-term infants and earlier intervention for those infants with special needs. (Author/CM)

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Title: Prediction of Infant Performance From Neonatal and Developmental Criteria

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ABSTRACT

The Neonatal Behavioral Assessment Scale (NBAS), in combination with medical histories and developmental assessments, was found to predict mental and motor performance at 9 months on the Bayley Scales of Infant Development (BSID). NBAS assessments at as early as 30 weeks gestational age were found related to BSID assessments at 2, 3, and 4 months of age. Patterns of pre-term infant performance on the NBAS emerged at 35 weeks gestational age. Discriminate Analysis yielded one hundred percent prediction of 9-month performance on the BSID and pre-term or full-term group membership. NBAS subscales and medical histories provided 3 of 4 predictors of normal function and 11 of 11 predictors of abnormal function. A neonatal assessment program can provide for earlier and more complete interdisciplinary involvement with "at risk" or pre-term infants and earlier intervention for those infants with special needs.

PURPOSE/METHODS

The Rockford Regional Perinatal Center in Rockford, Illinois is one of many regional centers that have provided early identification and determination of developmental deficiencies for the at risk infant. In an effort to improve the follow-up care level for this population, a three-part study was begun in July 1977. Since then, 427 infants who have complete medical histories and evaluation records have participated in the follow-up procedure.

Part I

Two hundred eighty-four infants were included in this phase of the study. All of these infants were delivered at or transferred immediately after birth to the Rockford Regional Perinatal Center from July 1977 to August 1979. All the infants were classified as "at risk" for potential abnormal development and were therefore included in the regular follow-up routine of evaluation clinic visits.

Table 1 gives the significant correlations between medical problems and the Bayley Scales of Infant Development (BSID) Mental and Motor Scores at 2, 4, 6 and 9 months of age. As in other studies, we have found low Apgar scores, premature birth and intrauterine growth status (SGA) to relate negatively to later development as measured by the BSID. In addition, medical histories that included respiratory distress. apnea, hypoxia, sepsis, HMD, hyperbilirubinemia, anemia and asphyxia, were all negatively related to BSID developmental scores. A history of diabetes in the family, single parenthood and a third or later pregnancy for the mother were all related to poor developmental histories. Female infants, as a group, did slightly better than males where overall developmental patterns were compared by sex.

TABLE 1

PEARSON CORRELATIONS OF NEONATAL MEDICAL HISTORIES AND BAYLEY SCALES OF INFANT DEVELOPMENT MENTAL AND MOTOR SCORES AT TWO, FOUR, SIX AND NINE MONTHS

	BSID 2 Month		BSID 4 Month		BSID 6 Month		BSID 9 Month	
	Mental	Motor	Mental	Motor	Mental	Motor	Mental	Motor
1 min. apgar					.3459*	.3221*		
5 min. apgar	.5268*	.5492**	-.4208**	-.4383**	.4538**	.4186**		
Gestational Age					.4773*	.4610*		
Apnea					.3526*	-.4586*		
Sepsis						-.4255*	-.9711**	-.4956**
Hyaline Membrane Disease	-.4411*		.3225*		-.3838*	-.3449*		
Hyperbilirubinemia	-.4377*							
Anemia					-.4702*	-.5233*		
Diabetes	.7788***	.7614***	.4830**	.4707**	.8222***	.8027***		
Gestational Age Group					-.4533*	-.5886**	.9711**	
Marital Status			-.5060***	-.5364***	-.5115*	-.4404*	-.6244***	-.6206***
Birth Order					.4169*			.3864*

* - Significant at .05
** - Significant at .01
*** - Significant at .001

Basic trends in the pre-term and "at risk" infant's developmental sequence emerged from this initial group of 284 infants. Comparisons could now be made between neonatal medical and clinical histories and later developmental sequences. Prediction of later developmental status could not be accomplished because as yet there was no criteria or justification for applying "normal" infant developmental sequences or norms to the pre-term infant population. In addition, there were no standarized assessments of infant developmental or behavioral status prior to discharge from the High Risk Unit.

Part II

In February 1978, Part II of this study was initiated in an effort to determine if neonatal assessments could predict later developmental outcome. In addition, an effort was made to determine if pre-term infant developmental sequences would follow those of full-term infants, if the infant's gestational age was utilized rather than the infant's chronological age.

Twenty-four infants, fourteen full-term AGA infants and ten AGA pre-term infants, were included. All infants were assessed using the Neonatal Behavioral Assessment Scale (NBAS) at 40, 42 and 44 weeks gestational and chronological age, and using the BSID at 2, 4, 6 and 9 months gestational and chronological age. Medical and familial histories were taken and held constant in an attempt to look only at the prediction qualities of neonatal assessments on the NBAS. The correlations of the NBAS assessments for this pilot group, with the respective BSID assessments, can be seen in Tables 2, 3, and 4.

As seen in Tables 2, 3, and 4 a relationship was found, for both full-term and pre-term infants, between BNAS and subsequent BSID assessments.

TABLE 2

GESTATIONAL AGE (GA) PRE-TERM INFANT GROUP (N=10)
PEARSON CORRELATIONS OF NEONATAL BEHAVIORAL ASSESSMENT SCALE (N) SUBSCALES (I, II, III, IV) AT 35 THROUGH 44 WEEKS AND THE BAYLEY SCALES OF INFANT DEVELOPMENT AT TWO, FOUR, SIX AND NINE MONTHS

	BSID 2 Month		BSID 4 Month		BSID 6 Month		BSID 9 Month	
	Mental	Motor	Mental	Motor	Mental	Motor	Mental	Motor
N III 35			.9976**	.9820*	.9976*	.9820	.9976*	.9820*
N III 36					-.9241*			
N I 37	-1.000***	-1.000***	1.000***	1.000***	-.9924*	-.9948*	1.000***	1.000***
N II 37	-1.000***	-1.000***	1.000***	1.000***	-.9924*	-.9948*	1.000***	1.000***
N III 37	-1.000***	-1.000***						
N II 38	-1.000***	-1.000***	1.000***	1.000***	-.9912*	-.9912*	1.000***	1.000***
N III 38					-.9912*			
N I 39	1.000***	-1.000***			-1.000***	-1.000***	1.000***	1.000***
N II 39	1.000***	-1.000***			-1.000***	-1.000***	1.000***	1.000***
N III 40			.9949***			-.7057*		
N I 41	-1.000***	-.9948*	-.8704*				1.000***	1.000***
N II 41	-1.000***	-.9948*					1.000***	1.000***
N III 41			.8773*	.8453*	.9774*	1.000***	1.000***	1.000***
N IV 41	-1.000***	-.9948*					1.000***	1.000***
N I 42	-.9049**		.7381*		-.7562*			
N II 42					-.7425*	-.6110*		.9820*
N III 42	-.8026*			.7125*			1.000***	
N I 44	-.5848*	-.8012**	.8104*					
N III 44				.6757*			-1.000***	
N IV 44							1.000***	

* - Significant at .05
** - Significant at .01
*** - Significant at .001

TABLE 3

CHRONOLOGICAL AGE (CA) PRE-TERM INFANT GROUP (N = 10) PEARSON CORRELATIONS OF NEONATAL BEHAVIORAL ASSESSMENT SCALE SUBSCALES AT 40 WEEKS, 42 WEEKS, AND 44 WEEKS AND THE BAYLEY SCALES OF INFANT DEVELOPMENT MENTAL AND MOTOR SCORES AT TWO, FOUR, SIX AND NINE MONTHS

	BSID 2 Month		BSID 4 Month		BSID 6 Month		BSID 9 Month	
	Mental	Motor	Mental	Motor	Mental	Motor	Mental	Motor
NBAS-III 40 Weeks				.618*				
NBAS-IV 40 Weeks			-.598*	-.618*			-.616*	-.586*
NBAS-I 42 Weeks	-.837***	-.650*						
NBAS-II 44 Weeks	-.648*		-.711**	-.776**	-.813**	-.780**	-.852***	-.899***
NBAS-II 44 Weeks			-.598*	-.618*			-.616*	-.586*
NBAS-IV 44 Weeks							.669*	.660*

* - Significant at .05
** - Significant at .01
*** - Significant at .001

TABLE 4

CHRONOLOGICAL AGE (CA) AND GESTATIONAL AGE (GA) FULL-TERM INFANT GROUP (N=14) PEARSON CORRELATIONS OF NEONATAL BEHAVIORAL ASSESSMENT SCALE SUBSCALES AT 40 WEEKS, 42 WEEKS, and 44 WEEKS AND THE BAYLEY SCALES OF INFANT DEVELOPMENT MENTAL AND MOTOR SCORES AT TWO, FOUR, SIX AND NINE MONTHS

	BSID 4 CA Mental	BSID 4 CA Motor	BSID 6 CA Mental	BSID 4 GA Mental	BSID 4 GA Motor	BSID 6 GA Mental
NBAS - I 40 Weeks			.459*			.459*
NBAS - I 42 Weeks			.459*			.459*
NBAS - II 42 Weeks	.499*			.499*		
NBAS - III 42 Weeks	.474*	.671**		.474*	.671**	

* - Significant at .05
** - Significant at .01

Therefore, we decided to attempt to predict developmental outcome on the BSID at nine months of age from the neonatal medical and developmental criteria.

Table 5 presents the results of the discriminate analysis used to determine the predictability of infant group membership by enonatal and developmental information. One hundred precent prediction was obtained, which means that given the information obtained, one could correctly predict whether an infant was pre-term or full-term.

Tables 6 and 7 present the most significant predictors ($p < .001$) obtained when a discriminate analysis was used to predict 9-month performance on the Mental and Motor Scales of the BSID from the developmental parameters obtained at 40, 42, and 44 weeks and at 2, 4, and 6 months. An eighty percent level of expected function was used as the discrimination line between normal and abnormal function at each evaluation. All infants were considered as a group. The timing of each infant's assessment was dependent on the gestational and/or chronological age of the infant. Lumping all infants together as a group and using a percent of expected function as a discrimination point allowed gestational age to be considered, in combination with all the other data, as a plausible cause of delayed development.

One hundred percent prediction of 9-month performance was obtained at each chronological and gestational age evaluation. In addition, predictive patterns emerged across all evaluations. Tables 8 and 9 present the common predictors of normal and abnormal mental and motor development as measured by the BSID at 9 months of age.

TABLE 5

DISCRIMINANT ANALYSIS OF STATISTICALLY SIGNIFICANT
PRE-TERM AND FULL-TERM ASSESSMENT DATA

Discriminant Function	Eigenvalue	Relative Percentage	Wilks Lambda	Chi-Square	df	Significance
1	19766.04	100.00	.0001	118.70	20	.001

Actual Group	N of Cases	Predicted Group Membership Pre-Term	Full-Term
Pre-Term	10	N = 10 100.0%	N = 0 0.0%
Full-Term	14	N = 0 0.0%	N = 14 100.0%

TABLE 6

SIGNIFICANT PREDICTORS OF NINE MONTH MENTAL PERFORMANCE

	CHRONOLOGICAL AGE		GESTATIONAL AGE	
AT:	NORMAL	ABNORMAL	NORMAL	ABNORMAL
6 Months	4 mo. Weight 40 wk. Habituation 42 wk. Habituation 44 wk. Orientation 6 mo. Chronological Mental	4 mo. Head Circumference 42 wk. Orientation 44 wk. Habituation 4 mo. Gestational Motor 6 mo. Chronological Motor	Size of Family Birth Order Birth Head Circumference 2 mo. Head Circumference 44 wk. Responses to Stress 6 mo. Chronological Mental	1 min. Apgar 44 wk. Weight 44 wk. Head Circumference 40 wk. Motoric Responses 44 wk. Habituation
4 Months	Gestational Age at Birth 2 mo. Chronological Mental 2 mo. Gestational Motor 4 mo. Gestational Mental	2 mo. Chronological Motor 2 mo. Gestational Mental 4 mo. Chronological Mental	2 mo. Head Circumference	1 min. Apgar 44 wk. Head Circumference 40 wk. Motoric Responses 44 wk. Habituation 2 mo. Gestational Mental
2 Months	Gestational Age at Birth 44 wk. Orientation 44 wk. Responses to Stress		2 mo. Head Circumference	1 min. Apgar 44 wk. Head Circumference 40 wk. Motoric Responses 44 wk. Habituation 2 mo. Gestational Mental
44 Weeks	Gestational Age at Birth Social Economic Status 40 wk. Motoric Responses 40 wk. Habituation 44 wk. Orientation 44 wk. Responses to Stress	Sex 1 min. Apgar Gestational Age Group 42 wk. Motoric Responses 44 wk. Habituation 44 wk. Orientation 44 wk. Responses to Stress	Race Size of Family Birth Order Birth Head Circumference 40 wk. Habituation 42 wk. Motoric Responses 44 wk. Responses to Stress	Sex 1 min. Apgar Gestational Age Group 44 wk. Head Circumference 40 wk. Motoric Responses 44 wk. Orientation 44 wk. Habituation

TABLE 7

SIGNIFICANT PREDICTORS OF NINE MONTH MOTOR PERFORMANCE

	CHRONOLOGICAL AGE		GESTATIONAL AGE	
AT	NORMAL	ABNORMAL	NORMAL	ABNORMAL
6 Months	Gestational Age at Birth 6 mo. Gestational Motor	Sex Race 4 mo. Head Circumference 2 mo. Chronological Motor 4 mo. Chronological Motor	Gestational Age at Birth 2 mo. Weight 2 mo. Gestational Motor	Sex Race 44 wk. Head Circumference 40 wk. Motoric Responses 40 wk. Habituation 44 wk. Orientation
4 Months	Gestational Age at Birth Social Economic Status 44 wk. Responses to Stress 2 mo. Chronological Mental 4 mo. Gestational Mental	Race 44 wk. Head Circumference 2 mo. Gestational Motor 4 mo. Chronological Mental	Gestational Age at Birth 2 mo. Weight 2 mo. Gestational Motor	Sex Race 44 wk. Head Circumference 40 wk. Motoric Responses 40 wk. Habituation 44 wk. Orientation 2 mo. Chronological Mental
2 Months	5 Min. Apgar 40 wk. Orientation 44 wk. Orientation 44 wk. Habituation	Race 42 wk. Orientation 42 wk. Motoric Responses	5 Min. Apgar	Sex 1 Min. Apgar 40 wk. Motoric Responses 42 wk. Motoric Responses 42 wk. Habituation 44 wk. Responses to Stress
44 Weeks	Gestational Age at Birth Social Economic Status 40 wk. Orientation 40 wk. Motoric Responses 44 wk. Orientation 44 wk. Responses to Stress	Sex Weight at Birth Race Size of Family 42 wk. Motoric Responses	Weight at Birth 5 Min. Apgar Social Economic Status Size of Family Gestational Age Group 44 wk. Weight 42 wk. Habituation 44 wk. Responses to Stress	Sex 1 Min. Apgar Race Birth Head Circumference 44 wk. Head Circumference 40 wk. Motoric Responses 40 wk. Habituation 44 wk. Orientation

TABLE 8

COMMON PREDICTORS OF NINE MONTH MENTAL PERFORMANCE*

	CHRONOLOGICAL AGE		GESTATIONAL AGE	
AT:	NORMAL	ABNORMAL	NORMAL	ABNORMAL
6 Months	44 wk. Orientation		2 mo. Head Circumference	1 min. Apgar 44 wk. Head Circumference 40 wk. Motoric Responses 44 wk. Habituation
4 Months	Gestational Age at Birth		2 mo. Head Circumference	1 min. Apgar 44 wk. Head Circumference 40 wk. Motoric Responses 44 wk. Habituation
2 Months	Gestational Age at Birth 44 wk. Orientation		2 mo. Head Circumference	1 min. Apgar 44 wk. Head Circumference 40 wk. Motoric Responses 44 wk. Habituation
44 Weeks	Gestational Age at Birth 44 wk. Orientation			1 min. Apgar 44 wk. Head Circumference 40 wk. Motoric Responses 44 wk. Habituation

* Common predictors were only those obtained from 3 of the 4 assessments.

TABLE 9

COMMON PREDICTORS OF NINE MONTH MOTOR PERFORMANCE*

	CHRONOLOGICAL AGE		GESTATIONAL AGE	
AT:	NORMAL	ABNORMAL	NORMAL	ABNORMAL
6 Months	Gestational Age at Birth	Race		Sex Race 44 wk. Head Circumference 40 wk. Motoric Responses 40 wk. Habituation 44 wk. Orientation
4 Months	Gestational Age at Birth	Race		Sex Race 44 wk. Head Circumference 40 wk. Motoric Responses 40 wk. Habituation 44 wk. Orientation
2 Months		Race		Sex 40 wk. Motoric Responses
44 Weeks	Gestational Age at Birth	Race		Sex Race 44 wk. Head Circumference 40 wk. Motoric Responses 40 wk. Habituation 44 wk. Orientation

* Common predictors were only those obtained from 3 of the 4 assessments.

Part III

With encouragement from this small pilot, and financial support from the Rockford Chapter of the March of Dimes, the Center began a comprehensive attempt to verify the findings of the pilot study. During the Fall and Winter of 1979-1980, 119 infants were evaluated while still hospitalized in the high risk unit. Their chronological ages at the time of evaluation ranged from three days to fourteen weeks and their gestational age range was thirty to forty-four weeks. Medical histories were taken by hospital staff but were unknown to the examiner. At the time of the assessments only Apgar scores, gestational age, birthdate and weight were known. Assessments using the NBAS were completed by the principal author in all cases. In each case, the assessment was scored following the standard examination procedures (Brazelton, 1973). Then the scores were grouped using a 3 point a-priori scoring system (Adamson, 1976). A value of 3 was poor, a value of 2 questionable, and a value of 1 judged within normal limits. In addition, a fifth score was given to each infant based on his or her performance and gestational age. Each infant's performance was critically, albeit subjectively, compared to Saint Anne-Dargassies' (1966) 30-42 week developmental sequence for pre-term infants. Therefore, even if the performance of the infant was judged poorly by the full-term a-priori standards of the NBAS, a means of comparison of his/her status by gestational age could be obtained using the Saint Anne-Dargassies' criterion. For the subjective psychologist ratings 1 = abnormal; 2 = poor; 3 = mixed; 4 = questionable; and 5 = within normal limits. The progression of a-priori scores and the subjective score can be seen in Table 10.

TABLE 10

AVERAGE NEONATAL BEHAVIORAL ASSESSMENT SCALE SUBSCALE RATINGS AND PSYCHOLOGIST RATINGS FOR GESTATIONAL AGES 30 TO 44 WEEKS

GESTATIONAL AGE	Subscale I Orientation*	Subscale II Motoric Processes*	Subscale III Habituation*	Subscale IV Responses to Stress*	Psychologist Rating **
30	3	3	3	1	2
31	3	3	3	1	4
32	3	3	3	1	2
33	3	3	3	1	4
34	3	3	3	1	4
35	3	3	3	1	4
36	3	3	2	1	4
37	3	3	2	1	3
38	3	3	2	1	4
39	3	3	2	1	3
40	3	2	2	1	3
41	3	2	2	1	4
42	2	2	2	1	5
43	3	2	2	1	4
44	2	1	1	1	5

* - 3 = poor, 2 = questionable, 1 = WNL
** - 1 = abnormal, 2 = poor, 3 = mixed, 4 = questionable, 5 = WNL

Comparisons were also made by gestational age of infants at the typically full-term assessments of 40, 42, and 44 weeks. Table 11 gives the frequency count by gestational age and the average testing for these infants at 40, 42, and 44 weeks. Table 12 gives the correlations of these infants for each of the NBAS subscale and psychologist ratings with their neonatal histories.

BSID assessments were only obtained on a limited number of these infants (N=10) because of the short duration of follow-up time to date. Tables 13 and 14 give the correlations of the medical problems, family history and NBAS assessments at 2, 3, and 4 months.

TABLE 11

GESTATIONAL AGES, NUMBER (N) AVERAGE NEONATAL BEHAVIORAL ASSESSMENT SCALE SUBSCALE RATINGS (I, II, III, IV) AND PSYCHOLOGIST RATING (Ψ) AT 40, 42, AND 44 WEEKS

	40 WEEKS RATINGS (Total N=20)						42 WEEKS RATINGS (Total N=8)						44 WEEKS RATINGS (Total N=5)					
GESTATIONAL AGE	N	I	II	III	IV	Ψ	N	I	II	III	IV	Ψ	N	I	II	III	IV	Ψ
30	1	3	3	2	1	2												
31																		
32																		
33	1	2	3	1	1	4												
34	1	2	2	1	1	3	2	3	3	1	1	4	3	2	1	1	1	5
35													1	3	3	3	1	2
36	3	3	3	2	1	4	2	3	3	2	1	4						
37	1	3	3	2	1	4												
38	2	3	3	3	1	3												
39	2	3	3	3	1	2												
40	9	3	2	2	1	3	3	2	2	2	1	5						
41							1	1	1	1	1	5						
42																		
43													1	2	2	1	1	4

TABLE 12

PEARSON CORRELATIONS OF NEONATAL MEDICAL PROBLEMS AND THE NEONATAL BEHAVIORAL ASSESSMENT SCALE SUBSCALES (I, II, III, IV) AND PSYCHOLOGIST (Ψ) RATINGS AT 40, 42, AND 44 WEEKS

	40 WEEKS (N=20)					42 WEEKS (N=8)				44 WEEKS (N=5)			
	I	II	III	IV	Ψ	I	II	III	Ψ	I	II	III	Ψ
1 Min. Apgar										-.9201		-.5204	-.3703
5 Min. Apgar						-.5052	-.3536	-.5303	-.5162	-.9510		-.4313	-.4069
Gestational Age	-.3217					-.5648	-.5487		.4088	-.3712			
Respiratory Distress						-.7259	-.4083						
Apnea	-.4901		-.5859				-.4083	-.4083	-.3974	-.3273		-.4083	
Hypoxia											-.3273	-.4083	
Sepsis							-.7093	-.4083		-.5345	-.8018	-1.000	-.9432
Hyaline Membrane Disease						-.3419	-.5345	-.8018	-.7804	-.3273		-.6124	-.5601
Hyperbilirubinemia						-.8564	-.7303						
Anemia						-.6030	-.3536	-.3536		-.7638	-.8729	-.4083	
Asphyxia							-.3652	-.5477	-.5331	-.8729	-.7638	-.6124	-.4901
Diabetes				-1.000									
Intrauterine Growth Status			-.3035		.3998					-.3273		-.6124	-.4901
Race				-.6883		-.5698	-.5345			-.4083			
Sex										.7638	.8719	.4083	-.5601
Marital Status		-.3532		-.5340	-.5698	-.4865	-.4027	-.3356		-.5345			-.3430
Birth Order				-.6309			-.7620	-.6350	-.7005	-.4286	-.6429	=.8018	-.6417

TABLE 13

PEARSON CORRELATIONS OF ASSESSMENTS ON THE NEONATAL BEHAVIORAL ASSESSMENT SCALES WITH NEONATAL MEDICAL PROBLEMS AND ASSESSMENTS ON THE BAYLEY SCALES OF INFANT DEVELOPMENT AT 2 AND 3 MONTHS

	32 Weeks N = 3		39 Weeks N = 3		
	Habituation	Y Rating	Motor	Habituation	Y Rating
2 month BSID Mental			.9663	.9656	.9663
2 month BSID Motor			1.0000	.8660	1.0000
3 month BSID Mental	- .9608	.9608			
3 month BSID Motor		.8030			
1 min. Apgar			- .9449	- .9449	.9449
5 min. Apgar	- .8660	.9992	- .9999	- .8660	.9999
Gestational Age	-1.000	1.000	- .7559	- .3273	
Respiratory Distress	-1.000	-1.000	-1.000	- .8660	-1.000
Apnea	-1.000	-1.000	-1.000	- .8660	-1.000
Hypoxia					
Sepsis			- .5000	- .8660	- .5000
Hyaline Membrane Disease					
Hyperbilirubinemia	-1.000	-1.000	- .5000		- .5000
Anemia	-1.000	-1.000	- .5000		- .5000
Asphyxia	-1.000	-1.000	-1.000	- .8660	-1.000
Diabetes					
Intrauterine Growth Status	1.000	1.000		- .8660	1.000
Race					
Sex	1.000	1.000			
Marital Status					
Birth Order		-1.000	- .9707	- .9608	- .9707

TABLE 14

PEARSON CORRELATIONS OF ASSESSMENTS ON THE NEONATAL BEHAVIORAL ASSESSMENT SCALES WITH NEONATAL MEDICAL PROBLEMS AND ASSESSMENTS ON THE BAYLEY SCALES OF INFANT DEVELOPMENT AT 4 MONTHS

	42 Weeks N = 3			
	Orientation	Motor	Habituation	↓ Rating
4 month BSID Mental	- .4542	- .4542		-.3401
4 month BSID Motor			-.6509	-.4252
1 min. Apgar				
5 min. Apgar	- .3216	- .3216	-.9285	.6065
Gestational Age	- .5555	- .5555	-.9263	.7857
Respiratory Distress	- .4042	- .4042	-.9802	-.6860
Apnea	- .3333	- .3333	-.5774	-.3333
Hypoxia	- .5774	- .5774		-.4083
Sepsis	- .3333	- .3333	-.5774	-.4714
Hyaline Membrane Disease	- .3333	- .3333	-.5774	-.9428
Hyperbilirubinemia	- .5774	- .5774	-.9999	-.8165
Anemia	- .3333	- .3333	-.5774	-.9428
Asphyxia				
Diabetes				
Intrauterine Growth Status				-.8165
Race	- .3333	- .3333	-.5774	-.4714
Sex	1.000	1.000	.5774	-.9428
Marital Status	- .3333	- .3333	-.5774	
Birth Order	- .4165	- .4165	-.7071	-.8660

SUMMARY

Assessments on the Neonatal Behavioral Assessment Scale (NBAS), at as early as 30 weeks of gestational age, were found to be positively related to developmental performance, as measured by the Bayley Scales of Infant Development (BSID), at 2, 3, and 4 months of age. NBAS assessments at 40, 42, and 44 weeks of gestational age, in combination with neonatal medical histories and BSID developmental assessments at 2, 4, and 6 months of age, were found to predict mental and motor development at 9 months of age on the BSID. Discriminate Analysis yielded 100% prediction of nine-month performance and identification of pre-term or full-term group membership. Neonatal medical histories, NBAS subscale scores at 44 weeks, and BSID Mental and Motor scores at 2, 4, and 6 months provided 3 of 4 predictors of normal function, and 11 of 11 predictors of abnormal function. In addition, certain predictors were identified to be specific at each of the 44 week, and 2, 4, and 6 month assessments individually, but were not predictive across all of the assessments when considered as a group. Psychologist ratings of infant status were also found to be positively related to developmental performance at 2, 3, and 4 months of age. The NBAS identified developmental sequences, beginning at 35 weeks gestational age, which provided verification of infant neurological maturation. Such change was noted in those infants with a more stable medical status.

Neonatal assessments, combined with psychologist ratings, provided verification of the infant's developmental status, gestational age, and neurological function. This methodology clarified specific problems and also demonstrated a delayed, though normal sequential pattern, consistent with full-term infant development. Neonatal assessments were found predictive of later development and assisted in planning intervention programs.

Medical histories with a high incidence of risk or complication continued to be negatively related to NBAS and BSID performance levels. The assessment program at the Rockford Regional Perinatal Center has provided the framework for earlier and more complete interdisciplinary involvement with each high risk infant, and earlier intervention for those infants with special needs.

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